substrate and a target molecule in a target liquid contained within a reaction chamber formed by the substrate and a cover is provided. The method comprises loading the target liquid in the reaction chamber; and inducing movement of the target molecules in the target liquid without physically translating either the substrate or the cover.

[0029] Other features and aspects of the invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings which illustrate, by way of example, the features in accordance with embodiments of the invention. The summary is not intended to limit the scope of the invention, which is defined solely by the claims attached hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0030] **FIG. 1** illustrates a prior art microarray hybridization device.

[0031] **FIG. 2** illustrates the effective sample volume in existing microarray hybridization devices.

[0032] **FIG. 3** is a perspective view of a capillary bundle in accordance with embodiments of the present invention.

[0033] **FIG. 4** illustrates a compound loading station in which a pressure chamber containing a compound library in microtiter plates is coupled to capillary bundles.

[0034] **FIG. 5** illustrates another parallel fluid delivery method utilizing gravity as the driving force.

[0035] **FIG. 6A** illustrates a method of functionalizing a substrate using protected-aldehyde silanization agent. **FIG. 6B** illustrates a method of functionalizing a substrate using maleimide silanization agent. **FIG. 6C** illustrates a method of activating the protected functional groups using light activation.

[0036] **FIG. 7** illustrates a process for fabrication using a negative mask.

[0037] **FIG. 8** illustrates a typical use of a chambered slide.

[0038] **FIG. 9** illustrates a magnetic cover slip.

[0039] **FIG. 10** illustrates a floating cover slip.

[0040] **FIG. 11** illustrates use of a vibrating cover slip.

[0041] **FIG. 12** illustrates use of a slide holder to immobilize the substrate slide while allowing the cover slip to move laterally in a relative larger area.

[0042] **FIG. 13** illustrates an apparatus that moves the substrate slide to enhance movement of target molecules.

[0043] **FIG. 14** illustrates a configuration of a sandwich hybridization chamber.

[0044] **FIG. 15** illustrates use of a slide holder to maintain pressure in the slide stack.

[0045] **FIG. 16** illustrates a configuration of the middle slide.

[0046] **FIG. 17** illustrates a middle slide and cover slip as an integrated piece.

[0047] **FIG. 18** illustrates a different configuration of the cover slip.

[0048] **FIG. 19** illustrates use of a hybridization device with an integrated upper slide.

[0049] **FIG. 20** illustrates a configuration using an immiscible fluid to prevent evaporation.

[0050] **FIG. 21** illustrates forced circulation using a volume exclusion fluid in combination with gravitational or centrifugal force.

[0051] **FIG. 22** illustrates use of magnetic beads to generate effective movement of target molecules.

[0052] **FIG. 23** illustrates another use of magnetic beads to enhance hybridization.

[0053] **FIG. 24** illustrates forced circulation using a magnetic fluid as the volume exclusion fluid and a magnetic field as the driving force.

[0054] **FIG. 25** illustrates use of ultrasonic waves to generate effective movement of target molecules within the hybridization chamber.

[0055] **FIG. 26** illustrates using an electric field to drive charged target molecules to migrate through the hybridization chamber along a predetermined route.

[0056] **FIG. 27** illustrates an example voltage distribution and sequence that transports the target molecule along the electrode pads.

[0057] **FIG. 28** illustrates another voltage sequence that transports the target molecules along the electrode pads.

[0058] **FIG. 29** illustrates an apparatus with a simplified electrode configuration that makes use of an electrophoresis mechanism to drive target molecules to migrate across the hybridization chamber.

[0059] **FIG. 30** illustrates use of upper electrode pads on the inner surface of the cover slip to reduce the voltage required for lateral transportation.

[0060] **FIG. 31** illustrates coating a conductive layer near the upper surface of the substrate slide to help reduce the voltage required for vertical transportation of target molecules.

[0061] **FIG. 32** illustrates use of upper electrode pads to transport target molecules towards the probes.

[0062] **FIG. 33** illustrates use of an electric field gradient to drive the negatively charged molecules in the target fluid.

[0063] **FIG. 34** illustrates use of Lorentz forces to move charged molecules in the target fluid.

[0064] **FIG. 35** illustrates alternative electrode designs for using Lorentz forces to move charged molecules in the target fluid.

[0065] **FIG. 36** illustrates use of localized heating/cooling to enhance movement of target molecules.

[0066] **FIG. 37** illustrates pumping target fluid through microfluidic channels fabricated on the cover slip.

[0067] **FIG. 38** illustrates a parallel channel design of microfluidic channels.

[0068] **FIG. 39** illustrates use of external pressure chambers to force the target fluid to flow back and forth through the microfluidic channels.